

CLAIMS:

1. An apparatus suitable for controlling a flow of a fluid within an intake passage of a reciprocating piston internal combustion engine, comprising:

5 a flow body mounted within the intake passage, wherein a fluid flow passage is defined between an inner surface of the intake passage and an outer surface of the flow body,

10 a valve member disposed within the intake passage and being reciprocally movable along the axial direction of the intake passage between a valve open position and a valve closed position, wherein at least a portion of the valve member defines a solenoid armature,

15 a first solenoid disposed on a first side of the solenoid armature and being arranged and constructed to attract the valve member towards the valve open position when the first solenoid is actuated, and

20 a second solenoid disposed on a second, opposite side of the solenoid armature and being arranged and constructed to attract the valve member towards the valve closed position when the second solenoid is actuated, wherein a portion of the fluid flow passage is defined through the second solenoid and the valve member is arranged and constructed to sealingly close the fluid flow passage when disposed on the valve closed position, and wherein the valve member is normally biased towards a central position between the first and second solenoid.

2. An apparatus as in claim 1, wherein the valve member is a substantially annular-shaped and the fluid flow path is a peripheral fluid flow path having a substantially annular cross-section.

5 3. An apparatus as in claim 2, wherein the second solenoid has an overall U-shape in half-cross-section, and comprises:

substantially cylindrical-shaped walls having mutually facing sides that define side wall portions of the fluid flow passage, and

10 a wall portion connecting the cylindrical-shaped walls, wherein at least one aperture is defined within the wall portion for permitting the fluid to pass therethrough.

4. An apparatus as in claim 3, wherein end faces of the substantially cylindrical-shaped walls define sealing contact faces arranged and constructed to contact the valve member.

15 5. An apparatus as in claim 4, wherein the second solenoid comprises an excitation coil disposed within a substantially annular-shaped recess.

6. An apparatus as in claim 5, wherein the first solenoid has a substantially annular configuration and the first solenoid has a diameter that is substantially equal to the diameter of the second solenoid.

20 7. An apparatus as in claim 6, further comprising a substantially annular-shaped groove defined within the first solenoid, which groove opens towards the second solenoid and wherein an excitation coil is disposed within the groove.

8. An apparatus as in claim 7, wherein the first solenoid is coupled to a wall of the intake passage, the substantially annular-shaped valve member is arranged and constructed to reciprocally press against pole faces of the first and second solenoid, the valve member further comprising a cylindrical-shaped portion disposed adjacent to the substantially annular disk, which cylindrical-shaped portion is arranged and constructed to axially slide along the inner surface of the intake passage, and wherein at least one opening is defined within the cylindrical-shaped portion.

9. An apparatus as in claim 7, wherein the first solenoid is mounted to the flow body and wherein first and second springs are supported on the flow body and bias the valve member towards the central position.

10. An apparatus as in claim 6, wherein an axially-extending fluid flow passage is defined within the flow body, which axially-extending fluid flow passage is not closable by the valve member, but is closable by a separate closing member.

11. An apparatus as in claim 1, wherein the second solenoid has an overall U-shape in half-cross-section, and comprises:

substantially cylindrical-shaped walls having mutually facing sides that define side wall portions of the fluid flow passage, and
20 a wall portion connecting the cylindrical-shaped walls, wherein at least one aperture is defined within the wall portion for permitting the fluid to pass therethrough.

12. An apparatus as in claim 11, wherein end faces of the substantially cylindrical-shaped walls define sealing contact faces arranged and constructed to contact the valve member.

5 13. An apparatus as in claim 1, wherein the second solenoid comprises an excitation coil disposed within a substantially annular-shaped recess.

14. An apparatus as in claim 1, wherein the first solenoid has a substantially annular configuration and the first solenoid has a diameter that is substantially equal to the diameter of the second solenoid.

10 15. An apparatus as in claim 1, further comprising a substantially annular-shaped groove defined within the first solenoid, which groove opens towards the second solenoid and wherein an excitation coil is disposed within the groove.

15 20 16. An apparatus as in claim 1, wherein the first solenoid is coupled to a wall of the intake passage, the solenoid armature is arranged and constructed to reciprocally press against pole faces of the first and second solenoid, the valve member further comprises a cylindrical-shaped portion disposed adjacent to the solenoid armature, which cylindrical-shaped portion is arranged and constructed to axially slide along the inner surface of the intake passage, and wherein at least one opening is defined within the cylindrical-shaped portion.

28. An apparatus as in claim 1, wherein the first solenoid is mounted to the flow body and wherein first and second springs are supported on the flow body and bias the valve member towards the central position.

18. An apparatus as in claim 1, wherein an axially-extending fluid flow passage is defined within the flow body, which axially-extending fluid flow passage is not closable by the valve member, and further comprising a separate closing member arranged and constructed to open and close the axially-extending fluid flow passage.

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19. An apparatus comprising:

an intake passage arranged and constructed to be coupled to a combustion chamber of a reciprocating piston internal combustion engine, means for defining a peripheral fluid flow passage within the intake passage,

a valve member disposed within the intake passage and being reciprocally movable along the axial direction of the intake passage, wherein at least a portion of the valve member defines an armature,

first means for magnetically attracting the armature,

second means for magnetically attracting the armature, the first and second means being disposed on opposite sides of the armature, wherein the peripheral fluid flow passage communicates with and extends through the second means and the second means defines a valve seat that closes the peripheral fluid flow path when the second means causes the valve member to press against the valve seat, and

means for normally biasing the valve member towards a position between the first and second means.

20. An apparatus as in claim 19, wherein the peripheral fluid flow path, the armature and the valve seat are substantially annular-shaped in cross-section.